Successful Coil Embolization for a "Three-Hump" Internal Carotid Artery Anterior Wall Aneurysm

A Case Report

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Summary

We describe an unusually shaped aneurysm arising from the anterior wall of the internal carotid artery (ICA) that was treated successfully with Guglielmi detachable coils (GDCs). A 38-year-old woman presented with sudden onset of headache and was transferred to our hospital. Computed tomography revealed thin subarachnoid hemorrhage in the basal cisterns. Three-dimensional rotational angiography clearly showed a "three-hump" anterior wall aneurysm of the ICA. The two distal humps of the aneurysm were successfully obliterated with GDCs, but the proximal hump was too small to treat by coil embolization. The patient was discharged without neurological deficit. Anterior wall (blister-like) aneurysms of the ICA have a high risk of rupture due to fragility of the wall. These aneurysms are considered difficult to manage by traditional surgical approaches. Our experience suggests that endovascular GDC embolization is a good alternative treatment modality for patients with such an aneurysm.

Introduction

Aneurysms located at non-branching sites in the supraclinoid portion of the internal carotid artery (ICA), known as anterior wall aneurysms, are rare [1]. Such aneurysms are characterized by a hemispheric or blood blister-like shape and fragile wall [2-4]. It is important to identify any blister-like ICA anterior wall aneurysms. These lesions are difficult to manage by traditional direct clipping [1,2], and coil embolization has recently been shown to be effective [5]. We describe herein an unusually shaped, i.e., a "three-hump", anterior wall aneurysm of the ICA that was treated successfully by the endovascular approach.

Case Report

A 38-year-old woman was admitted to Yamato Municipal Hospital on August 19, 2003. One hour previously, she had suffered the sudden onset of severe headache and vomiting. Upon admission, her consciousness was clear and there was no neurological deficit. Her medical history did not include any abnormality. Her mother, however, suffered subarachnoid hemorrhage and underwent clipping operations for multiple aneurysms. Computed tomography examination of our patient on admission showed subarachnoid hemorrhage (figure 1). Emergent four-vessel angiography revealed an unusually shaped anterior wall aneurysm of the left ICA (figure 2A,B). Three-dimensional rotational angiography showed clearly that, in shape, the aneurysm resembled the three humps of a camel (figure 2C,D). Therefore, we named this aneurysm a "three-hump aneurysm" of the anterior wall portion of

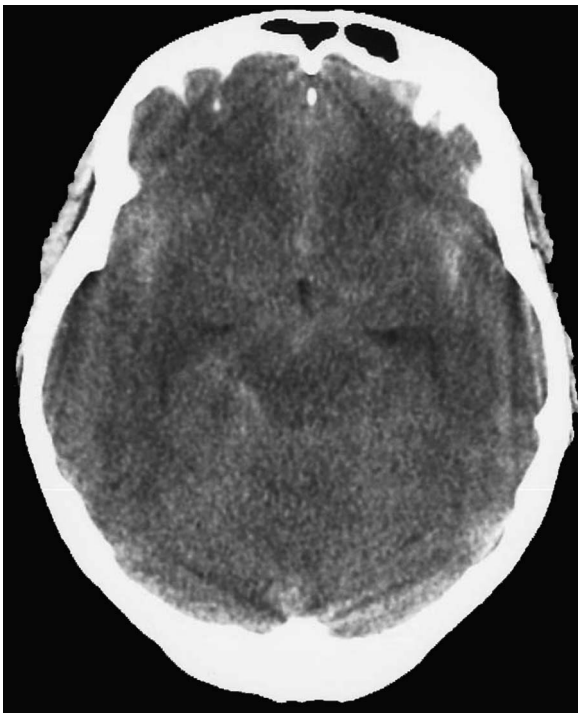

Figure 1 Initial CT scans shows thin subarachnoid hemorrhage in the basal cisterns and sylvian fissure.

the left ICA. Cross flow through the anterior communicating artery from the right ICA was shown to be sufficient in the present case. We selected endovascular treatment with GDCs rather than direct clipping because of the shape of aneurysm and the risk of intraoperative rupture during clipping. On the day after the subarachnoid hemorrhage, endovascular embolization was performed under intravenous anesthesia with propofol.

The bleb formation or the larger hump was considered the likely point of rupture; thus, coil embolization for the three-hump aneurysm was begun at the most distal hump. Two coils were used: a GDC-10 soft 2 mm x 8 cm coil and a GDC-10 soft 2 mm x 4 cm coil (Boston Scientific, Natick, Mass., USA). With this procedure, the most distal hump was appropriately obliterated. On the next day, coil embolization of the middle hump was performed under general anesthesia. The lesion was satisfactorily obliterated with only one coil (GDC-10 soft 2 mm x 6 cm). The two distal humps of the aneurysm were successfully obliterated with GDCs (figure 3), but the proximal hump was too small to treat by GDC embolization.

The postoperative course was uneventful. Postoperative angiography revealed satisfactory embolization. The patient was discharged in excellent condition. Follow-up angiography undertaken six months after the embolization showed complete obliteration of two distal humps and no growth of the small proximal hump.

Discussion

The ICA anterior wall aneurysm in the present case was characterized by a three-hump configuration. Preoperative three-dimensional rotational and intraoperative superselective angiography showed clearly that each hump of the aneurysm had its own neck (figure 2 A-D). Therefore, the pathogenesis of this unfamiliar aneurysm probably differed from that of the ordinary saccular berry aneurysm with multiple blebs.

The majority of saccular aneurysms of the ICA are located at the branching site in the supraclinoid segment; aneurysms located at a non-branching site in the supraclinoid ICA are rare, comprising 0.3% to 1% of intracranial aneurysms and 0.9% to 6.5% of all ICA aneurysms [1,2]. These aneurysms are characterized by a blood blister-like configuration and fragile wall [2-4]. ICA anterior wall aneurysms of the sac-

Table 1 **Reported cases of ruptured ICA anterior wall aneurysm treated by coil embolization**

	Age(yrs)/Sex	Preop Grade*	Outcome
McNeely P.D. et Al [7])	55/male	II	Excellent
Ahn JY et Al [2]	50/male	III	Excellent
Present case	38/female	II	Excellent

**Grade determined preoperatively by Hunt & Kosnik grading system*

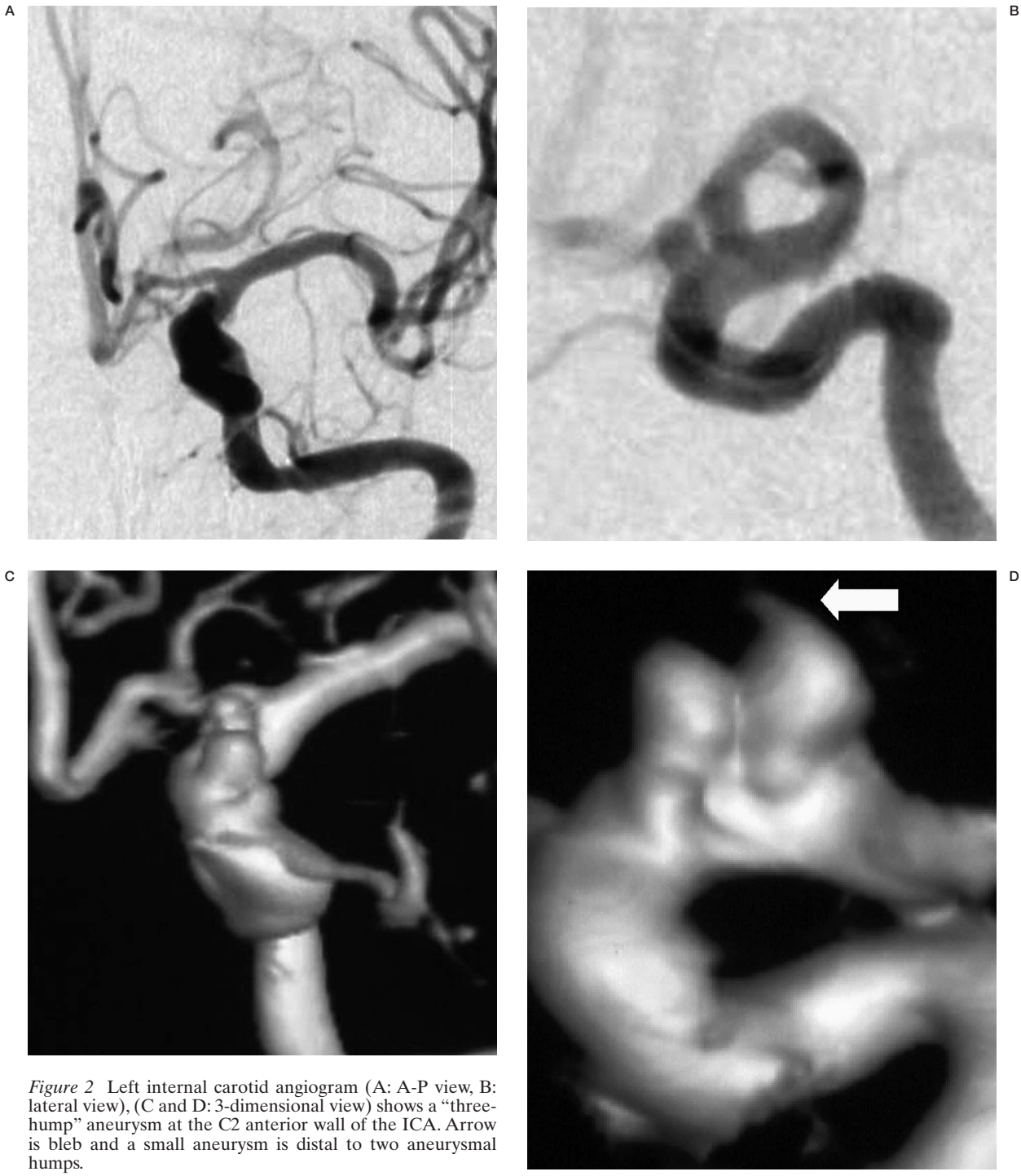

Figure 2 Left internal carotid angiogram (A: A-P view, B: lateral view), (C and D: 3-dimensional view) shows a "three-hump" aneurysm at the C2 anterior wall of the ICA. Arrow is bleb and a small aneurysm is distal to two aneurysmal humps.

cular type can occur and are characterized by a relatively firm neck. The incidence of blister type ICA anterior wall aneurysms (83%) was reported to be significantly higher than the incidence of saccular type ICA anterior wall aneurysms (17%).

The clinical features of ICA anterior wall aneurysms of the blister type include female dominance, high incidence in younger patients with subarachnoid hemorrhage, associated hypertension, and arteriosclerosis or dissection of the ICA [1-4,6-8].

Figure 3 Left internal carotid angiogram shows complete obliteration of two of the three aneurysmal humps after embolization.

The wall of the blister-like ICA anterior wall aneurysm is so thin and fragile that direct clipping often results in intra- or postoperative rupture of the lesion [1-3,5]. Therefore, several alternative procedures have been devised [1,2,5,9]. Wrapping and clipping and endovascular occlusion of the cervical ICA with or without bypass surgery have been performed [1-3]. These are effective but may fail to prevent growth of the aneurysm [2].)

The surgical outcomes for patients with blister type aneurysms were worse than patients with saccular type aneurysms; favorable outcomes were 50% to 60% [1-3]. Patients with blister type aneurysm vs. patients with saccular type aneurysm were more often given a poor clinical grade preoperatively due to massive subarachnoid hemorrhage, and blister type aneurysms with a poor clinical grade more often yield a poor surgical outcome. Thus, previous reports have suggested that blister-like ICA anterior wall aneurysms are difficult to manage using only traditional surgical approaches [1,2].

Endovascular treatment for paraclinoid aneurysms has recently been reported to be a safe and effective therapeutic alternative [9-11]. The relatively high mortality and morbidity associated with direct clipping of blister type aneurysms led us to select coil embolization as our first treatment choice, although this can also be difficult because of the broad neck and the fragile wall of the aneurysm. To reduce the likelihood of catastrophic aneurysmal perforation, tight and dense packing with coils was not performed; we used soft coils. Two soft GDC coils were used for the most distal hump of the aneurysm, and one soft coil was used for the middle hump. Two humps were obliterated satisfactorily. We had been prepared for proximal ICA embolization and the balloon assisted technique to treat the aneurysm if it had ruptured during embolization. Because of good cross circulation from right to left through the anterior communicating artery, the most proximal hump of the aneurysm was small, with a wide neck; therefore, it was difficult to manage by endovascular treatment.

To our knowledge, there are only two reported cases in which endovascular treatment was used for a ruptured blister-like aneurysm of the anterior wall of the ICA[5,12] (Table 1). McNeely et Al emphasized that endovascular GDC embolization is an appropriate treatment modality in cases of blister-like ICA anterior wall aneurysm [5]. They advised that tight dense packing with coils should be avoided and that soft coils should be used for blister-like aneurysms to reduce the likelihood of aneurysmal rupture during embolization [5]. Concerning an unruptured paraclinoid aneurysm, Iihara et Al reported that endovascular therapy vs. direct surgery for superiorly projecting (possibly including anterior wall blister-like) aneurysms is associated with lower rates of complete obliteration, and higher rates of transient and permanent morbidity [9].

They recommended direct surgery for the treatment of paraclinoid aneurysms projecting superiorly [9]. Thus, the optimal treatment strategy for blister-like aneurysms of the ICA remains uncertain. Although further clinical experience in endovascular treatment of anterior wall blister-like aneurysms of the ICA is needed, our experience thus far suggests that endovascular GDC embolization is a viable alternative treatment modality for these aneurysms. To improve treatment it is necessary for stents in coil and balloon assisted techniques to be performed for these aneurysms.

References

1 Ogawa A, Suzuki M, Ogasawara K: Aneurysms at nonbranching sites in the supraclinoid portion of the internal carotid artery: internal carotid artery trunk aneurysms. Neurosurgery 47: 578-586, 2000.
2 Abe M, Tabuchi K, Yokoyama H et Al: Blood blister-like aneurysms of the internal carotid artery. J Neurosurg 89: 419-424, 1998.
3 Nakagawa F, Kobayashi S et Al: Aneurysms protruding from the dorsal wall of the internal carotid artery. J Neurosurg 65: 303-308, 1986.
4 Shigeta H, Kyoshima K et Al: Dorsal internal carotid artery aneurysms with special reference to angiographic presentation and surgical management. Acta Neurochir (Wien) 119: 42-48, 1992.
5 McNeely PD, Clarke DB et Al: Endovascular treatment of a "blister-like" aneurysm of the internal carotid artery. Can J Neurol Sci 27: 247-250, 2000.
6 Endo S, Takaba M et Al: Pathological study of intracranial artery dissection with subarachnoid hemorrhage. Surg Cereb Stroke (Jpn) 25: 169-176, 1997.
7 Sato A, Nakamura H et Al: High risk aneurysms of the internal carotid artery: dorsal IC aneurysms. Surg Cereb Stroke (Jpn) 21: 467-472, 1993.
8 Suzuki J, Ohara H: Clinicopathological study of cerebral aneurysms: origin, rupture, repair, and growth. J Neurosurg 48: 505-514, 1978.
9 Iihara K, Murao K et Al: Unruptured paraclinoid aneurysms: a management strategy. J Neurosurg 99: 241-247, 2003.
10 Hoh BL, Carter BS et Al: Results after surgical and endovascular treatment of paraclinoid aneurysms by a combined neurovascular team. Neurosurgery 48:7 8-90, 2003.
11 Park HK, Horowitz M et Al: Endovascular treatment of paraclinoid aneurysms: experience with 73 patients. Neurosurgery 53: 14-24, 2003.
12 Ahn JY, Kwon SO, Joo JY: Dorsal internal carotid artery aneurysm treated by coil embolization.-case report- Neurol Med Chir (Tokyo) 41: 603-606, 2001.

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EDITORIAL COMMENT

The authors describe a case for which coil embolization was chosen as treatment for a "blister-like" aneurysm on the supraclinoid portion of the internal carotid artery, a localization also referred to in the litterature as "carotid anterior wall aneurysms". They describe their succesful management in this case and suggest that endovascular coiling is a reasonable treatment modality for these patients.

The strategy proposed in this paper is somewhat controversial since the common opinion is that these lesions frequently are due to a dissection process and thereby represent very fragile lesions. The surgical appearance is often a thin walled lesion which ruptures easily when trying to apply a standard clip. Instead, the use of an encircling clip graft has been advocated for lesions like this. Although GDC coiling appear to have worked for two thirds of the lesion in this case, it is probably not reasonable to recommend GDC coiling as a general treatment for these lesions considering their frequent inherent fragility. This is in analogy with the danger in coiling dissections in the posterior circulation. The aim of the treatment for "blister-like" aneurysms should be to exclude them entirely and this was not possible with the modality chosen in the present case.

The litterature and different opinions in the treatment for lesions like these are described in a recent article in Neurosurgery (Sekula FR et Al, Neurosurgery, (2006) 59: Suppl. 1, operative neurosurgery), and also the published comments on that article speaks in favour of using either an encircling clip graft, or trapping the vascular segment, or possible coiling through an open stent. It is, however, possible that GDC coiling of "blister-like" aneuryms in this location is a viable alternative for selected lesions when the other modalities are not appropriate. The term "three-hump" for this lesion is not ideal since the nomenclature of aneurysms being located at non-branching sites of the supraclinoid portion of the internal carotid artery is already unclear and this term further adds to the confusion.

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